

**Amendments to the Claims**

The listing of claims will replace all prior versions and listings of claims in the application:

**5    Listing of Claims:**

1. (currently amended) A storage virtualization computer system comprising:
  - a host entity for issuing IO requests;
  - an external storage virtualization controller coupled to said host entity for
  - 10        executing IO operations in response to said IO requests; and
  - a group of physical storage devices (PSDs), each coupled to the external storage virtualization controller through a point-to-point serial-signal interconnect, for providing storage to the storage virtualization computer system through the external storage virtualization controller;
  - 15        wherein said external storage virtualization controller comprises:
    - a central processing circuitry for performing said IO operations in response to said IO requests of said host entity;
    - at least one IO device interconnect controller coupled to said central processing circuitry;
    - 20        at least one host-side IO device interconnect port provided in one of    said at least one IO device interconnect controller for coupling to said host entity; and
    - at least one device-side IO device interconnect port provided in one of said at least one IO device interconnect controller for coupling to said group of
    - 25        PSDs through said point-to-point serial-signal interconnect, said device-side IO device interconnect port being a serial port for point-to-point serial-signal transmission;
    - wherein said computer system further comprises a detachable canister attached to said external storage virtualization controller for containing one of said PSDs
    - 30        therein;

- wherein said external storage virtualization controller is configured to define at least one logical media unit (LMU) consisting of sections of said group of PSDs, and is configured to provide a mapping that maps combination of the sections of said group of PSDs to the at least one LMU visible to the host entity, and the at least one LMU is contiguously addressable by the host entity to which the at least one LMU is made available; and
- wherein said external SVC issues a device-side IO request to said IO device interconnect controller, and said IO device interconnect controller re-formats said device-side IO request and accompanying IO data into at least one data packet for transmission to said group of PSDs through said device-side IO device interconnect port; and
- wherein a new PSD ~~can be~~ is attached to said external storage virtualization controller when said external storage virtualization controller is on-line.
- 15 2. (original) The storage virtualization computer system of claim 1 wherein said point-to-point serial-signal interconnect is a Serial ATA IO device interconnect.
- 20 3. (previously presented) The computer system of one of claims 1 and 2, wherein said group of PSDs comprises a SATA PSD.
4. (previously presented) The computer system of one of claims 1 and 2, wherein said group of PSDs comprises a PATA PSD and a serial-to-parallel converter is provided between one of said device-side IO device interconnect port and said PATA PSD.
- 25 5. (cancelled)
- 30 6. (previously presented) The computer system of one of claims 1 and 2, wherein one of said PSDs can be detached from said external storage virtualization controller when said external storage virtualization controller is on-line.

7-9. (cancelled)

10. (previously presented) The storage virtualization computer system of claim 1  
5 wherein one of said host-side IO device interconnect port and one of said device-side IO device interconnect port are provided in a same IO device interconnect controller.
11. (previously presented) The storage virtualization computer system of claim 1  
10 wherein said at least one IO device interconnect controller comprises a plurality of IO device interconnect controllers; wherein one of said host-side IO device interconnect port and one of said device-side IO device interconnect port are provided in different IO device interconnect controllers.
12. (previously presented) The computer system of one of claims 1 and 2, wherein  
15 said external storage virtualization controller comprises a plurality of host-side IO device interconnect ports each for coupling to a host-side IO device interconnect.
13. (currently amended) The computer system of claim 12, wherein said external  
20 storage virtualization controller is configured to present redundantly ~~a logical media unit on~~ the at least one LMU through at least two of said plurality of host-side IO device interconnect ports.
14. (previously presented) The computer system of claim 1, wherein at least one said  
25 host-side IO device interconnect port is Fibre Channel supporting point-to-point connectivity in target mode.
15. (previously presented) The computer system of claim 1, wherein at least one said  
30 host-side IO device interconnect port is Fibre Channel supporting private loop

connectivity in target mode.

16. (previously presented) The computer system of claim 1, wherein at least one said  
host-side IO device interconnect port is Fibre Channel supporting public loop  
5 connectivity in target mode.
17. (previously presented) The computer system of claim 1, wherein at least one said  
host-side IO device interconnect port is parallel SCSI operating in target mode.
- 10 18. (previously presented) The computer system of claim 1, wherein at least one said  
host-side IO device interconnect port is ethernet supporting the iSCSI protocol  
operating in target mode.
- 15 19. (previously presented) The computer system of claim 1, wherein at least one said  
host-side IO device interconnect port is Serial-Attached SCSI (SAS) operating in  
target mode.
- 20 20. (previously presented) The computer system of claim 1, wherein at least one said  
host-side IO device interconnect port is Serial ATA operating in target mode.
21. (currently amended) A storage virtualization subsystem for providing storage to a  
host entity, comprising:  
an external storage virtualization controller for connecting to the host entity and  
executing IO operations in response to IO requests issued from said host  
25 entity; and  
a group of physical storage devices (PSDs), each coupled to the external storage  
virtualization controller through a point-to-point serial-signal interconnect,  
for providing storage to the host entity through the external storage  
virtualization controller;  
30 wherein said external storage virtualization controller comprises:

a central processing circuitry for performing said IO operations in response to  
said IO requests of said host entity;  
at least one IO device interconnect controller coupled to said central processing  
circuitry;  
5 at least one host-side IO device interconnect port provided in one of said at least  
one IO device interconnect controller for coupling to said host entity; and  
at least one device-side IO device interconnect port provided in one of said at  
least one IO device interconnect controller for coupling to said group of  
PSDs through said point-to-point serial-signal interconnect, said  
10 device-side IO device interconnect port being a serial port for  
point-to-point serial-signal transmission;  
wherein said subsystem further comprises a detachable canister attached to said  
external storage virtualization controller for containing one of said PSDs  
therein;  
15 wherein said external storage virtualization controller is configured to define at  
least one logical media unit (LMU) consisting of sections of said group of  
PSDs, and is configured to provide a mapping that maps combination of the  
sections of said group of PSDs to the at least one LMU visible to the host  
entity, and the at least one LMU is contiguously addressable by the host entity  
20 to which the at least one LMU is made available; and  
wherein said external SVC issues a device-side IO request to said IO device  
interconnect controller, and said IO device interconnect controller re-formats  
said device-side IO request and accompanying IO data into at least one data  
packet for transmission to said group of PSDs through said device-side IO  
25 device interconnect port.

22. (original) The storage virtualization subsystem of claim 21 wherein said  
point-to-point serial-signal interconnect is a Serial ATA IO device interconnect.

30 23. (cancelled)

24. (previously presented) The storage virtualization subsystem of claim 21 wherein one of said host-side IO device interconnect port and one of said device-side IO device interconnect port are provided in a same IO device interconnect controller.
- 5
25. (previously presented) The storage virtualization subsystem of claim 21 wherein said at least one IO device interconnect controller comprises a plurality of IO device interconnect controllers; wherein one of said host-side IO device interconnect port and one of said device-side IO device interconnect port are provided in different IO device interconnect controllers.
- 10
26. (previously presented) The storage virtualization subsystem of claim 21, wherein said group of PSDs comprises a SATA PSD.
- 15
27. (previously presented) The storage virtualization subsystem of claim 21, wherein said external storage virtualization controller comprises a plurality of host-side IO device interconnect ports each for coupling to a host-side IO device interconnect.
- 28-29. (cancelled)
- 20
30. (previously presented) The storage virtualization subsystem of claim 21, wherein said group of PSDs comprises a PATA PSD and a serial-to-parallel converter is provided between one of said device-side IO device interconnect port and said PATA PSD.
- 25
31. (cancelled)
32. (previously presented) The storage virtualization subsystem of claim 21, wherein one of said PSDs can be detached from said external storage virtualization controller when said external storage virtualization controller is on-line.
- 30

33. (previously presented) The storage virtualization subsystem of claim 21, wherein  
said a new PSD can be attached to said external storage virtualization controller  
when said external storage virtualization controller is on-line.
- 5
34. (previously presented) The storage virtualization subsystem of claim 21, wherein  
said group of PSDs include a first set of PSDs and a second set of PSDs, said first  
set of PSDs and said second set of PSDs are not received in a same enclosure, and  
said external storage virtualization controller further comprises at least one  
multiple-device device-side expansion port for coupling to said second set of said  
10 PSDs.
35. (previously presented) The storage virtualization subsystem of claim 21, wherein  
at least one said host-side IO device interconnect port is Fibre Channel supporting  
15 point-to-point connectivity in target mode.
36. (previously presented) The storage virtualization subsystem of claim 21, wherein  
at least one said host-side IO device interconnect port is Fibre Channel supporting  
private loop connectivity in target mode.
- 20
37. (previously presented) The storage virtualization subsystem of claim 21, wherein  
at least one said host-side IO device interconnect port is Fibre Channel supporting  
public loop connectivity in target mode.
- 25
38. (previously presented) The storage virtualization subsystem of claim 21, wherein  
at least one said host-side IO device interconnect port is parallel SCSI operating in  
target mode.
- 30
39. (previously presented) The storage virtualization subsystem of claim 21, wherein  
at least one said host-side IO device interconnect port is ethernet supporting the

iSCSI protocol operating in target mode.

- 5      40. (previously presented) The storage virtualization subsystem of claim 21, wherein  
at least one said host-side IO device interconnect port is Serial-Attached SCSI  
(SAS) operating in target mode.
- 10      41. (previously presented) The storage virtualization subsystem of claim 21, wherein  
at least one said host-side IO device interconnect port is Serial ATA operating in  
target mode.
- 15      42. (previously presented) The storage virtualization subsystem of claim 21 further  
comprising an enclosure management services mechanism.
- 20      43. (original) The storage virtualization subsystem of claim 42, wherein said enclosure  
management services mechanism manages and monitors at least one of the  
following devices belonging to the storage virtualization subsystem: power  
supplies, fans, temperature sensors, voltages, uninterruptible power supplies,  
batteries, LEDs, audible alarms, PSD canister locks, door locks.
- 25      44. (original) The storage virtualization subsystem of claim 42, wherein said enclosure  
management services mechanism is configured to support direct-connect EMS  
configuration.
- 30      45. (original) The storage virtualization subsystem of claim 42, wherein said enclosure  
management services mechanism is configured to support device-forwarded EMS  
configuration.
- 30      46. (original) The storage virtualization subsystem of claim 42, wherein said enclosure  
management services mechanism is configured to support direct-connect EMS  
configuration and device-forwarded EMS configuration.

47. (original) The storage virtualization subsystem of claim 42, wherein said enclosure management services mechanism is configured to support SES enclosure management services protocol.
- 5
48. (original) The storage virtualization subsystem of claim 42, wherein said enclosure management services mechanism is configured to support SAF-TE enclosure management services protocol.
- 10 49. (previously presented) The storage virtualization subsystem of claim 42, wherein said EMS mechanism further comprises I2C latches to communicate with said external storage virtualization controller.
- 15 50. (previously presented) The storage virtualization subsystem of claim 42, wherein said EMS mechanism further comprises status-monitoring circuitry to communicate with said external storage virtualization controller.
- 20 51. (previously presented) The storage virtualization subsystem of claim 42, wherein said EMS mechanism further comprises the following mechanism to communicate with said external storage virtualization controller: I2C latches and status-monitoring circuitry.
- 25 52. (original) The storage virtualization subsystem of claim 42, wherein said EMS mechanism further comprises a CPU for running a program.
53. (previously presented) The storage virtualization subsystem of claim 42, wherein said EMS mechanism further comprises at least one I2C interconnect as a primary communication media to said external storage virtualization controller.
- 30 54. (withdrawn) An external storage virtualization controller for executing IO

operations in response to IO requests from a host entity, comprising:

- a central processing circuitry for performing IO operations in response to said IO requests of said host entity;
- at least one IO device interconnect controller coupled to said central processing circuitry;
- at least one host-side IO device interconnect port provided in a said at least one IO device interconnect controller for coupling to said host entity; and
- at least one device-side IO device interconnect port provided in a said at least one IO device interconnect controller for coupling to and performing point-to-point serial-signal transmission with at least one physical storage device.

55. (withdrawn) The external storage virtualization controller of claim 54 wherein said device-side IO device interconnect controller comprises at least one Serial ATA port, each for connecting to a said at least one physical storage device through a Serial ATA IO device interconnect.

56. (withdrawn) The external storage virtualization controller of one of claims 54 and 55 wherein a said host-side IO device interconnect port and a said device-side IO device interconnect port are provided in the same IO device interconnect controller.

57. (withdrawn) The external storage virtualization controller of one of claims 54 and 55 wherein a said host-side IO device interconnect port and a said device-side IO device interconnect port are provided in different IO device interconnect controllers.

58. (withdrawn) The external storage virtualization controller of one of claims 54 and 55 wherein said device-side IO device interconnect controller further comprises a PCI/PCI-X interface for connecting to the central processing circuit.

59. (withdrawn) The external storage virtualization controller of one of claims 54 and 55 wherein said device-side IO device interconnect controller further comprises a PCI Express interface for connecting to the central processing circuit.

5

60. (withdrawn) The external storage virtualization controller of one of claims 54 and 55, wherein said storage virtualization controller comprises a plurality of host-side IO device interconnect ports each for coupling to a host-side IO device interconnect.

10

61. (withdrawn) The external storage virtualization controller of one of claims 54 and 55, wherein said storage virtualization controller is configured for defining at least one logical media unit consisting of sections of said at least one PSD.

15 62. (withdrawn) The external storage virtualization controller of claim 60, wherein said storage virtualization controller is configured for presenting redundantly a logical media unit on at least two of said plurality of host-side IO device interconnect ports.

20 63. (withdrawn) The external storage virtualization controller of one of claims 54 and 55, wherein at least one said PSD is a direct-access storage device (DASD) and said storage virtualization controller is configured for defining a logical media unit consisting of sections of at least one said direct access storage device and said logical media unit is of RAID level or a combination of RAID levels, whereby  
25 said logical media unit is contiguously addressable by said host entity.

64. (withdrawn) The external storage virtualization controller of one of claims 54 and 55 further comprising at least one multiple-device device-side expansion port for accommodating a second set of at least one PSD.

30

65. (withdrawn) The external storage virtualization controller of one of claims 54 and 55, wherein at least one said host-side IO device interconnect port is Fibre Channel supporting point-to-point connectivity in target mode.
- 5 66. (withdrawn) The external storage virtualization controller of one of claims 54 and 55, wherein at least one said host-side IO device interconnect port is Fibre Channel supporting private loop connectivity in target mode.
- 10 67. (withdrawn) The external storage virtualization controller of one of claims 54 and 55, wherein at least one said host-side IO device interconnect port is Fibre Channel supporting public loop connectivity in target mode.
- 15 68. (withdrawn) The external storage virtualization controller of one of claims 54 and 55, wherein at least one said host-side IO device interconnect port is parallel SCSI operating in target mode.
- 20 69. (withdrawn) The external storage virtualization controller of one of claims 54 and 55, wherein at least one said host-side IO device interconnect port is ethernet supporting the iSCSI protocol operating in target mode.
70. (withdrawn) The external storage virtualization controller of one of claims 54 and 55, wherein at least one said host-side IO device interconnect port is Serial-Attached SCSI (SAS) operating in target mode.
- 25 71. (withdrawn) The external storage virtualization controller of one of claims 54 and 55, wherein at least one said host-side IO device interconnect port is Serial ATA operating in target mode.
- 30 72. (withdrawn) The external storage virtualization controller of one of claims 54 and 55 further comprising an enclosure management services mechanism.

73. (withdrawn) The storage virtualization controller of claim 72, wherein said enclosure management services mechanism is configured to support direct-connect EMS configuration.
- 5
74. (withdrawn) The storage virtualization controller of claim 72, wherein said enclosure management services mechanism is configured to support device-forwarded EMS configuration.
- 10
75. (withdrawn) The storage virtualization controller of claim 72, wherein said enclosure management services mechanism is configured to support direct-connect EMS configuration and device-forwarded EMS configuration.
- 15
76. (withdrawn) The storage virtualization controller of claim 72, wherein said storage virtualization controller is configured to support SES enclosure management services protocol.
- 20
77. (withdrawn) The storage virtualization controller of claim 72, wherein said storage virtualization controller is configured to support SAF-TE enclosure management services protocol.
- 25
78. (currently amended) A method for performing storage virtualization in a computer system with an external storage virtualization controller of the computer system, the method comprising:
- receiving, by the external storage virtualization controller, an IO request from a host entity of the computer system;
- parsing, by the external storage virtualization controller, the IO request to decide at least one IO operation to perform in response to said IO request;
- performing, by the external storage virtualization controller, at least one IO operation to access a group of physical storage devices (PSDs) of the
- 30

computer system in point-to-point serial-signal transmission; and  
performing said at least one IO operation by a central processing circuitry in the  
external storage virtualization controller in response to said IO request of  
said host entity;

5 wherein said external storage virtualization controller includes:  
at least one IO device interconnect controller coupled to said central processing  
circuitry;  
at least one host-side IO device interconnect port provided in one of said at least  
one IO device interconnect controller for coupling to said host entity; and  
10 at least one device-side IO device interconnect port provided in one of said at  
least one IO device interconnect controller for coupling to said group of  
PSDs through said point-to-point serial-signal interconnect, said device-side  
IO device interconnect port being a serial port for point-to-point  
serial-signal transmission;

15 wherein said computer system further comprises a detachable canister attached to  
said external storage virtualization controller for containing one of said PSDs  
therein;

wherein said external storage virtualization controller is configured to define at  
least one logical media unit (LMU) consisting of sections of said group of  
20 PSDs, and is configured to provide a mapping that maps combination of the  
sections of said group of PSDs to the at least one LMU visible to the host  
entity, and the at least one LMU is contiguously addressable by the host  
entity to which the at least one LMU is made available; and

wherein said external SVC issues a device-side IO request to said IO device  
25 interconnect controller, and said IO device interconnect controller re-formats  
said device-side IO request and accompanying IO data into at least one data  
packet for transmission to said group of PSDs through said device-side IO  
device interconnect port; and wherein said group of PSDs include a first set of  
PSDs and a second set of PSDs, said first set of PSDs and said second set of  
30 PSDs are not received in a same enclosure, and said external storage

virtualization controller further comprises at least one multiple-device device-side expansion port for coupling to said second set of said PSDs.

- 5 79. (original) The method of claim 78 wherein the point-to-point serial-signal transmission is performed in a format complying with a Serial ATA protocol.
80. (original) The method of one of claims 78 and 79 further comprising the step of providing an enclosure management services mechanism.
- 10 81. (original) The method of claim 80 further comprising the step of executing said enclosure management services mechanism when said mechanism is configured to support direct-connect EMS configuration.
- 15 82. (original) The method of claim 80 further comprising the step of executing said enclosure management services mechanism when said mechanism is configured to support device-forwarded EMS configuration.
- 20 83. (original) The method of claim 80 further comprising the step of executing said enclosure management services mechanism when said mechanism is configured to support direct-connect EMS configuration and device-forwarded EMS configuration.
- 25 84. (previously presented) The method of claim 80 further comprising the step of executing said enclosure management services mechanism when said external storage virtualization controller is configured to support SES enclosure management services protocol.
- 30 85. (previously presented) The method of claim 80, further comprising the step of executing said enclosure management services mechanism when said external storage virtualization controller is configured to support SAF-TE enclosure

management services protocol.

86. (previously presented) The method of one of claims 78 and 79, wherein said group of PSDs comprises a SATA PSD.

5

87. (original) The method of one of claims 78 and 79, wherein said group of PSDs comprises a PATA PSD and serial signals in said serial signal transmission are converted by a serial-to-parallel converter to parallel signals compliant with said PATA PSD.

10

88-89. (cancelled)

90. (currently amended) A computer-readable storage medium having a computer program code stored therein that is capable of causing a computer system having an external storage virtualization controller and a group of physical storage devices (PSDs) connected to the external storage virtualization controller to perform the steps of:

15 receiving, by the external storage virtualization controller, an IO request from a host entity of the computer system;  
20 parsing, by the external storage virtualization controller, the IO request to decide at least one IO operation to perform in response to said IO request;  
performing said at least one IO operation with the external storage virtualization controller to access said group of PSDs in point-to-point serial-signal transmission; and  
25 performing said at least one IO operation by a central processing circuitry in the external storage virtualization controller in response to said IO request of said host entity;

wherein said external storage virtualization controller includes:

30 at least one IO device interconnect controller coupled to said central processing circuitry;

at least one host-side IO device interconnect port provided in one of said at least one IO device interconnect controller for coupling to said host entity; and at least one device-side IO device interconnect port provided in one of said at least one IO device interconnect controller for coupling to one of said PSDs through said point-to-point serial-signal interconnect, said device-side IO device interconnect port being a serial port for point-to-point serial-signal transmission;

wherein said computer system further comprises a detachable canister attached to said external storage virtualization controller for containing one of said PSDs therein;

wherein said external storage virtualization controller is configured to define at least one logical media unit (LMU) consisting of sections of said group of PSDs, and is configured to provide a mapping that maps combination of the sections of said group of PSDs to the at least one LMU visible to the host entity, and the at least one LMU is contiguously addressable by the host entity to which the at least one LMU is made available; [[and]]

wherein said external SVC issues a device-side IO request to said IO device interconnect controller, and said IO device interconnect controller re-formats said device-side IO request and accompanying IO data into at least one data packet for transmission to said group of PSDs through said device-side IO device interconnect port; and

wherein the external storage virtualization controller is configured to present redundantly ~~a logic media unit on~~ the at least one LMU through at least two of said plurality of host-side IO device interconnect ports.

25

91. (original) The computer-readable storage medium of claim 90 wherein the point-to-point serial-signal transmission is performed in a format complying with a Serial ATA protocol.

30

92. (previously presented) The computer-readable storage medium of one of claims 90

and 91, wherein said group of PSDs comprises a SATA PSD.

93. (previously presented) The computer-readable storage medium of one of claims 90  
and 91, wherein said group of PSDs comprises a PATA PSD and serial signals in  
5 said serial signal transmission are converted by a serial-to-parallel converter to  
parallel signals compliant with said PATA PSD.

94-96. (cancelled)

10 97. (previously presented) The storage virtualization computer system of claim 1,  
wherein said group of PSDs are received in a plurality of enclosures.

98. (previously presented) The storage virtualization subsystem of claim 21, wherein  
said group of PSDs are received in a plurality of enclosures.

15 99. (previously presented) The method of claim 78, wherein said group of PSDs are  
received in a plurality of enclosures.

100. (previously presented) The computer-readable storage medium of claim 90,  
20 wherein said group of PSDs are received in a plurality of enclosures.

101. (previously presented) The storage virtualization computer system of claim 1,  
wherein said group of PSDs include a first set of PSDs and a second set of PSDs,  
said first set of PSDs and said second set of PSDs are not received in a same  
25 enclosure, and said external storage virtualization controller further comprises at  
least one multiple-device device-side expansion port for coupling to said second  
set of said PSDs.

102. (cancelled)  
30

103. (previously presented) The computer-readable storage medium of claim 90,  
wherein said group of PSDs include a first set of PSDs and a second set of PSDs,  
said first set of PSDs and said second set of PSDs are not received in a same  
enclosure, and said external storage virtualization controller further comprises at  
5 least one multiple-device device-side expansion port for coupling to said second  
set of said PSDs.